

# Analysing Online Communities for Health Promotion: Characteristics of Digital Platforms Supporting Physical Activity

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**Abstract:** The objective of this study was to analyse existing digital platform (DP) characteristics of online communities (OC) to promote physical activity (PA). Previously DP identified in our previous scoping review were matched against our inclusion criteria. DP were included if mainly used to promote PA and were free of access. In addition to the general attributes of each DP, data was retrieved on user engagement strategies, BCT, and platform credibility. A total of 50 DP were found in our Google search. Fourteen OC from the Google search and 3 OC from our previous scoping review (n=17) were included in this study. Most DP (13; 64.70%) use an activity tracker—either external or internal—to support users on PA self-monitoring, almost all DP (16; 94.12%) included GPS connectivity features, and about half of selected DP (9; 52.94%) had a forum for community interaction. We found references to 26 (92.86%) of the 28 strategies used for analysis. While research on OC to promote PA and DP characteristics has been growing, existing DP does not provide detailed information on its attributes, nor comprehensive, specific data on engagement strategies and BCT.


## 1 INTRODUCTION

While digital platforms (DP) have gained significant attention in recent years for promoting physical activity (PA), online communities (OC) within these platforms provide a dynamic and cost-effective way to engage wider audiences. Moreover, the features of DP that host OC play a critical role in determining the extent and duration of user engagement, which directly influences the success of these communities in increasing members' PA levels (Manzoor et al., 2016; Resnick et al., 2010).

User engagement encompasses participation dynamics and collaboration within online environments, where individuals can interact, express themselves, and challenge their personal goals and mental models. Strategies to promote engagement in DP are varied and can include storytelling, calls-to-action, involving celebrities, using emotionally-triggering content, photos of program-related activities, collaboration with users for post imagery, or user-tagging in posts (Andrade et al., 2018); exclusive access to registered users (Ba & Wang, 2013); dashboard personalisation (Boratto et al., 2017); open-ended questions to users, rewards for

posting, responsive DP manager communication, or facilitating self-introductions between users and DP managers (Richardson et al., 2010); prohibition of commercial messages, no toleration for disrespectful language, enforcement of organised, fragmented discussions, or DP conversation thread style adapted to public audience (Lopez-Gonzalez et al., 2014); comment section, user reaction in posts, consistent forum content postings, prearranged 3-5 weekly tasks, or interactive podcast content (Mailey et al., 2019); or reward users for showing skills and expertise, notifications, custom usernames, custom avatar, in-person meetings, consent of privacy limits, or possibility to open camera directly in the DP (Malinen & Ojala, 2011).

In addition to strategies aiming to keep the user engaged with the OC hosted in a specific DP, there is a need to also consider the use of behaviour change techniques (BCT) as the aim is to promote PA, i.e., to change behaviour. BCT are observable and repeatable elements of behaviour change interventions that, when employed alone or in combination, can contribute to behaviour change (Abraham & Michie, 2008; Cane et al., 2015). The relevance of BCT originates from their value in raising collaborative

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responsiveness to change behaviour (Lopez-Gonzalez et al., 2014).

There are two indicators in BCT that studies have acknowledged so far—the relevance of the number of BCT to apply, and the importance of self-regulation strategies (Bondaronek et al., 2018).

Existing reports do not provide thorough discussions on BCT or user engagement strategies. In fact, when it comes to deciding what type of content to share in OC to promote PA, and what user engagement strategies to use, a set of guidelines is yet to be established. This explains the pertinence of exploring characteristics of PA-related OC's supporting DP.

However, despite the potential benefits of using OC in DP and the importance of DP characteristics to support OC in promoting PA, specific barriers must be overcome. One of the most critical ones is the long-term maintenance of user engagement (Kolt et al., 2020; Tague et al., 2014; Toscos et al., 2010).

## 2 MATERIALS AND METHODS

Our main research question is: “What are the main characteristics of DP aiming to promote PA?”. This question was operationalized in specific research questions:

- 1) What are the attributes of these DP?
- 2) Which BCT are currently used in these DP?
- 3) What strategies are implemented to keep user engagement in these DP?
- 4) How credible are these DP?

### 2.1 Identification of Relevant DP

First, we checked if the DP identified in our previous scoping review (Hachiya, 2023) met this study's inclusion and exclusion criteria. Additionally, we used Google's related searches (i.e., "People also searched for") to find additional DP related to the promotion of PA. The search was performed on December 16th, 2021.

The website search results from Google search were exported into Microsoft Excel (Microsoft, 16.56) and duplicates were removed. DP were screened against inclusion criteria by one author and discrepancies were discussed with a second reviewer.

DP were included if they supported an OC that: is used mainly to promote PA; targets the general public; is free of access or has a free version available. DP were excluded if they: mention PA but its main aim is not to promote PA; are used exclusively for research purposes; are in other languages besides

English, Portuguese, French and/or Spanish; and are no longer active or currently under development.

### 2.2 Data Collection

In addition to the general attributes of each DP (Table 1, Appendix A), data was retrieved on user engagement strategies, BCT, and platform credibility. The first two DP were analysed by the author and two reviewers and results were discussed to clarify doubts and fine-tune the methodology.

To be able to collect the necessary data, the author registered in the DP as a regular user. To analyse more specific elements of the DP—such as activity upload options, activity interactions among users, the existence of leaderboards, GPS connectivity, activity import features, number of PA available, and types of PA available—we created specific activities and uploaded them in the DP. For this, we used the Garmin Vivoactive 4S, an activity tracker with Global Positioning System (GPS), then performed and recorded two different activities: an approximate 1 km walk and two 60-minute dance classes. These activities were uploaded in each DP which allowed for the upload of data regarding PA.

When DP were available in multiple formats, desktop websites were prioritised in this analysis due to their broad advantages over apps. In DP in which the app format is the only option for analysis, we downloaded and evaluated the app using a mobile device with iOS. In cases where DP have both a free and a premium version, we only evaluated the free version. We based all data on the information available in each DP after login.

To gather missing or outdated DP attribute information, we contacted each DP through their contact email or the help form. All table categories were identified with corresponding DP attributes. When the information could not be determined, the attributes were labelled as inconclusive.

### 2.3 Data Analysis and Reporting

We checked the app download page or desktop website to find data such as DP support, type, device compatibility, languages available, registered category, subscription type, subscription fee and other DP history information (i.e., year of inception, partner accounts). The extracted information can be found in Table 1 (Appendix A).

User engagement strategies were characterised against the 28 specific actions detailed in Table 2 and were developed based on the work of several authors (Andrade et al., 2018; Ba & Wang, 2013; Boratto et

al., 2017; Kolt et al., 2020; Lopez-Gonzalez et al., 2014; Mailey et al., 2019; Malinen, 2015; Resnick et al., 2010; Richardson et al., 2010).

Table 2: List of 28 actions related to user engagement strategies.

ENGAGEMENT STRATEGIES	DESCRIPTION
Calls-to-action	DP uses prompts to trigger an immediate response from users (e.g., E-mail or in-app notifications)
Camera feature available in platform	Users can open the camera app directly in platform to post visual content or upload-only option is available
Collaboration with users for post imagery	Users are asked to share images in posts, and/or allow DP managers to use users' posted content
Comment section	Users can comment threads
Consent of privacy limits	Users can edit their privacy options
Consistent forum content postings	DP managers ensure forum always contains 5 to 10 messages posted per day
Content report to DP managers	Users can flag posts and/or comments
Dashboard personalisation	Users can customise the main page interface of their data visual display
DP conversation thread adapted to public audience	DP either uses a flat display of conversation threads in DP with users low to no experience using forums, or a nested display of conversation threads in DP with experienced forum users
DP custom avatar	Users can upload a profile picture representative of their identity
DP custom usernames	Users are asked to define a username for the DP
DP only available to registered users	Users must sign-up to platform to access DP
Emotionally triggering content	DP content includes humour or shock appeals (e.g., Show examples of what can happen if PA is low)
Forbid commercial messages	Non-DP related posts that sponsor other brands are not permitted
Highlighting the involvement of celebrities	DP showcases sponsored athlete profiles
In-person meetings	DP allows to create in-person events for users to meet and PA in group
Interactive podcast content	DP publishes a podcast
No toleration for disrespectful language	Users who use insults or profane language in DP may see their account banned or deleted
Open-ended question	Users are asked open-ended questions on self-regulation strategies to overcome barriers and describe successes
Organise fragmented discussions	DP managers make sure discussions remain organised in a few separate forums
Photos of program-related activities	Users can share photos of their PA (e.g., Venue, view, selfies, etc.)
Questions to users	Users receive various prompts to respond to
Responsive DP manager communication	DP managers post responses, usually within 24 hours, to all user posts and/or contacts, DP managers perform forum seeding, conversation bumping and replies
Self-introductions between users and DP managers	DP users are encouraged to write about themselves and get to know other users and DP managers
Set up at least 3-5 weekly tasks	Users are challenged to perform at least 3-5 weekly tasks (e.g., A 10-minute walk, writing down ten things they are grateful for)
Storytelling	DP provides user space to tell stories
User reaction in posts	Users can like/rate threads
User-tagging in posts	Users can tag others in posts

BCT were matched against the BCT Taxonomy developed by Abraham and Michie (2008), which includes 40 hierarchically clustered BCT that were categorised as being present or absent. The BCT Taxonomy can be found in Table 3 (Appendix A).

To analyse DP credibility, we collected the shared content sources, the existence of monitoring of shared information within these DP, and contribution and/or content quality check from specialists associated with the shared information (e.g., contribution of health professionals). We classified 17 documental quality indicators as present or absent using Bagrichevsky and Vasconcellos-Silva's (2019) Checklist (see Table 4, Appendix A). However, as there was not enough DP data for a full evaluation, five indicators—contact validity (10), usability (14), certification (15),

conflicts of interest (16), and objectivity (17)—were not assessed. Nevertheless, we evaluated the key aspects of digital platform usability, including authorship, link coherence, help accessibility, and information management options.

Finally, we coded each option individually as being present or absent and performed a quantitative analysis method of frequencies for all research questions. Moreover, we also used the DP number of users to perform a cross-tabulation analysis.

### 3 RESULTS

After checking the 22 DP identified in our previous study against the current study inclusion and exclusion criteria, 18 were excluded because they were no longer active (n=4), were used exclusively for research purposes (n=7), we were unable to find them (n=3), were in language outside of the inclusion criteria scope (n=1), promoting PA was not its main aim (n=1), required paid membership (n=1), and were still under development (n=1). Details on each excluded DP can be found in Table 5 (Appendix A).

Only three DP from our scoping review were included in the current study: Movescount, Strava, and RunKeeper. Details on each included DP can be found in Table 6 (Appendix A).

In the Google search, we found 24 DP in searches related to the Movescount DP, 18 related to the RunKeeper and 21 related to Strava. Of these 63 DP, 13 were repeated, and 50 DP were checked against inclusion and exclusion criteria. To explore the details. The full results for "People also searched for" related searches can be accessed in Table 7 (Appendix A).

After checking each 50 of the DP against the inclusion and exclusion criteria, 30 were excluded because they mentioned PA, but their main aim was not to promote PA, 2 were DP with paid memberships, and 2 because they were not a DP (1 was a PA log-only app, and 1 was a running plan in podcast format). Consequently, 14 DP from the Google search and 3 DP from the scoping review (n=17) were included in this study for further analysis. For more details on this, see Table 8 (Appendix A).

#### 3.1 Existent DP Attributes

Only 9 (52.94%) of 17 DP have a specific forum for the community to interact and/or ask community support questions. Of the 17 selected DP, none were supported in website-only format, 6 (35.29%) DP

were supported in app-only format and 11 DP were supported in both website and app format. Most DP (13; 64.70%) use an activity tracker—either external or internal—to support users on PA self-monitoring, almost all DP (16 out of 17; 94.12%) included GPS connectivity features and roughly half of selected DP (9 out of 17; 52.94%) had a forum within their OC for users to interact with each other—either by accessing and sharing their own PA or to request peer-to-peer user support. When it comes to DP subscription types, 5 (29.41%) were completely available free of access and 12 (70.59%) comprised two versions—a free and a premium one.

On what refers to language availability of DP, Garmin Connect TM took over with 35 languages. That is almost double the number of languages available in the second DP with the most language availability, Sports Tracker (n=19). As for the DP with the least number of languages available, there were two: Charity Miles and Zombies, Run!, which were only available in English. The data frequency of language availability is presented in Table 9 (Appendix A).

Regarding the number of PA types available in the DP, both Garmin Connect TM (n=95) and Sports Tracker (n=91) take the lead with a significantly greater amount of PA available than their counterparts. The DP with the least number of PA are RunKeeper, Strava, Adidas Running App Run Tracker, Nike Run Club, Map My Run by Under Armour, Map My Ride GPS Cycling Riding, and Fitbit with only one PA type available. Data on the number of PA types available in each DP, the current number of users in DP and the year of launch are presented in Table 10 (Appendix A).

### 3.2 Behaviour Change Techniques in DP

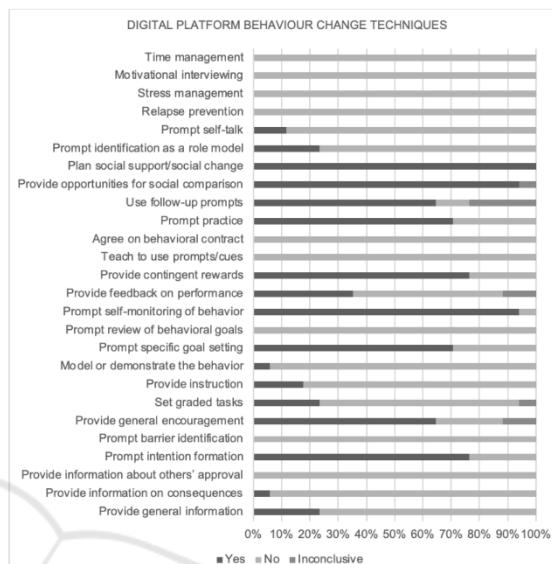
We found reference to at least one BCT in the 17 selected DP. Only one BCT was reported in all 17 DP (i.e., Plan social support or social change).

The most reported BCT (with a reporting frequency between 50 and 100%) were: prompt intention formation, provide general encouragement, prompt specific goal setting, prompt self-monitoring of behaviour, provide contingent rewards, prompt practice, and use follow-up prompts.

Nine BCT were not reported at all in any of the DP considered: provide information about others' approval, prompt barrier identification, prompt review of behavioural goals, teach to use prompts/cues, agree on behavioural contract, relapse prevention, stress management, motivational

interviewing, and time management. Table 12 presents the BCT and their respective frequency of reporting in the selected DP.

Table 12: Presence of BCT.



### 3.3 User Engagement Strategies

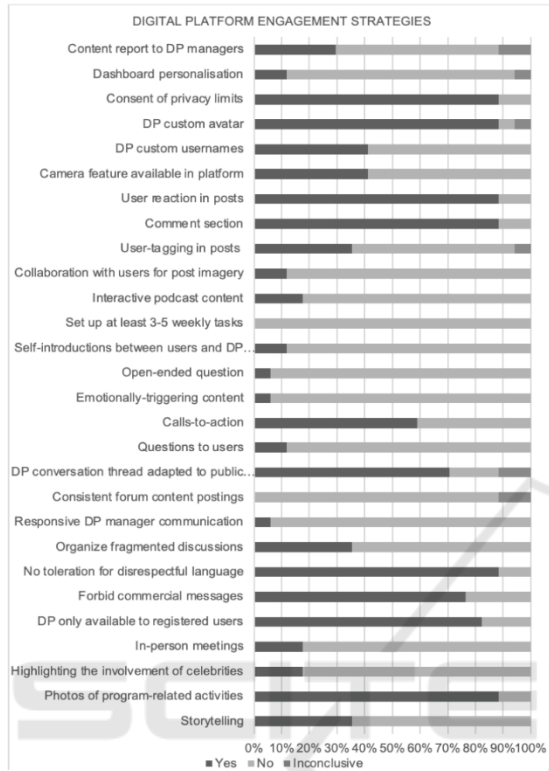
We found references to 26 (92.86%) of the 28 strategies used for analysis. The two user engagement strategies “Set up at least 3-5 weekly tasks” and “consistent forum content postings” were not found at all. Table 13 presents the 28 actions related to user engagement strategies and their respective frequency of reporting in the selected DP.

The most reported actions related to user engagement (with a reporting frequency between 50 and 100%) were: photos of program-related activities, DP only available to registered users, forbid commercial messages, no toleration for disrespectful language, DP conversation thread adapted to public audience, calls-to-action, comment section, user reaction in posts, DP custom avatar, and consent of privacy limits.

The least reported actions related to user engagement (with a reporting frequency between 0 and 49%) were: storytelling, highlighting the involvement of celebrities, in-person meetings, organise fragmented discussions, responsive DP manager communication, questions to users, emotionally triggering content, open-ended questions, self-introductions between users and DP managers, interactive podcast content, collaboration with users for post imagery, user-tagging in posts, camera feature available in the platform, DP custom

usernames, dashboard personalization, and content report to DP managers.

Table 13: Frequency of user engagement strategies.



### 3.4 DP Credibility

We found reference to at least one indicator in the 17 selected DP of the 12 indicators present in our adapted version of Bagrichevsky and Vasconcellos-Silva's (2019) checklist.

The most reported indicators (with a reporting frequency between 50 and 100%) were: authorship, coherence of the title and the content, dates of creation and web publication, links, coherence of links, the existence of contact details, help, information management, and navigability. The least reported indicators (with a reporting frequency between 0 and 49%) were: promoting body, endorsement, and date of update. To access details regarding the respective frequency of credibility indicators found in the selected DP, see Table 14 (Appendix A).

## 4 DISCUSSION

This DP analysis aimed to characterise selected DP, according to our inclusion and exclusion criteria, by

identifying the main attributes in DP, finding which BCT are present in these DP, what type of user engagement strategies can be detected and how credible are DP.

Considering the increase of DP launches over the last years, results suggest that the number of successful DP have been increasing. Most DP are supported by both website and app formats, available in a reasonable number of languages, accommodating a reduced amount of PA types, and a significant amount of DP with both free and premium versions.

When evaluating BCT, DP appeared to include the necessary components for PA promotion success (Kolt et al., 2020; Mailey et al., 2019), whereas when evaluating user engagement techniques in DP, we identified low reports on consistency, active engagement, and personalisation actions. Finally, Presence of DP credibility indicators appear considerable, validating the selected DP in the study.

### 4.1 Overview of DP Attributes

It was interesting that of so many DP, only roughly 50% had a specific forum and/or a feature for users to request support. Especially considering the importance of interaction and social support in PA (World Health Organization, 2020) and how specific forums and community power enhance a sense of community and social responsibility (Kalgotra et al., 2021; Romeo et al., 2019).

Considering the number of DP available only in app format and the benefits of using a website and app (Gordon & Crouch, 2019), DP might benefit from being supported in both formats simultaneously. This could increase user opportunities to access DP, thus increasing DP resources and dependability, which has previously been reported as a barrier to users' consistency in OC interaction (Kolt et al., 2020; Mailey et al., 2019; Tague et al., 2014).

The fact that roughly 30% of analysed DP are completely free of access was quite impressive, however, the fact that 70% of DP comprises two versions, can also be rather beneficial. Complete free access might widen user access, however, when a service is paid, it also heightens the commitment the user must make to the DP responsibility (Kalgotra et al., 2021; Romeo et al., 2019), hence possibly increasing accountability and discipline for frequent and/or long-term usage—which has been reported (Kolt et al., 2020; Tague et al., 2014). as one of the main problems in user engagement maintenance.

Language variety might also tell a lot about a DP's overall success (Bondaronek et al., 2018; Preece, 2001). Although of the 17 selected DP, 6 DP

included 15 or more languages, it is significant that 11 DP were available in less than 15 languages. This presented a noteworthy discrepancy between the DP with the highest number of available languages ( $n = 35$ ) and the DP with the least languages available ( $n = 1$ ). This might explain DP shortage of PA promotion effectiveness and user engagement success and interfere with a thorough, accurate analysis. That is, some DP might still be under development and, therefore still lack expected resources.

However, a deeper analysis must be done to understand what makes DP have limited language availability. A few reasons for this might be that: users are not accessing the DP in other countries in which the languages are not available nor requesting specific language accessibility besides English, and language diversity in DP is not being reported as a determining factor for usage (Bondaronek et al., 2018), or DP are not interested in expanding the number of users, or prioritising localization.

In terms of available PA types in DP, the discrepancy between the ones with more and fewer types of PA is considerable. With this, we can more easily presume that PA-related DP can mostly be divided into two categories: DP that are pervasive, and DP that choose to specialise in a certain PA type. This could be correlated with the fact that DP with more PA types available has their own PA tracking device—which makes it even more complete.

## 4.2 Behaviour Change Techniques

Studies have shown the importance of BCT's presence in DP, especially when there is a specific goal to change health behaviours. Accordingly, in this case, we aimed to understand which BCT were being applied in OC. Included studies report on 17 of the 26 BCT described by Abraham and Michie (2008).

Although it is noteworthy to mention that BCT such as planning social support or social change have been identified in all analysed DP, other likewise relevant BCT were not found at all (i.e., teach to use prompts/cues, time management, and stress management), or infrequently reported (i.e., provide instruction, and model or demonstrate the behaviour). This is significant because difficulty in navigating through DP due to a lack of resources and dependability is frequently reported as a problem in DP long-term success (Kolt et al., 2020; Tague et al., 2014) and, also, as a user barrier to lack of consistency when using a DP (Mailey et al., 2019; Rose et al., 2018; Toscos et al., 2010).

Additionally, prompting users to perform barrier identification, another one of the BCT that was not present in any of the DP might refrain DP from gaining more insight on what can be done to promote PA more efficiently (Mailey et al., 2019; Rose et al., 2018).

As many studies agree, self-motivation is an important factor in building on intrinsic motivation (Edney et al., 2017). This might explain previous reports on the low effectiveness of digital interventions to promote PA (Greene et al., 2013; Mailey et al., 2019) which simultaneously mention digital interventions as possibly successful in influencing behavioural change (Manzoor et al., 2016; Richardson et al., 2010).

Additionally, we found that BCT related to prompting users to perform specific actions (i.e., prompt intention formation, prompt specific goal setting, prompt self-monitoring of behaviour, prompt practice, and use follow-up prompts) were among the most reported BCT.

However, we also found that DP fails to give enough attention to actions that directly relate to trigger user accountability in DP engagement through information sharing (Parker et al., 2021), such as: providing general information and providing information on consequences (for not performing a specific activity) and, especially, providing feedback on performance. This might explain low DP effectiveness since, as previous studies have reported, receiving external positive encouragement in tasks might motivate users to perform that action more (Boratto et al., 2017; Mitchell et al., 2018), which might ultimately help DP contribute to influencing PA.

## 4.3 Strategies to Engage Users in DP

The integration of user engagement strategies is fundamental to exploring DP effectiveness in promoting PA and creating an engaging environment that will encourage user retention in the DP (Lopez-Gonzalez et al., 2014; Tague et al., 2014). This ongoing gap in guideline availability might influence the recurrent mention of difficulty in lengthening long-term engagement in DP (Edney et al., 2017; Manzoor et al., 2016; Tague et al., 2014).

Overall, DP seems to cover important actions in fundamental healthy community guidelines (i.e., forbid commercial messages, no toleration for disrespectful language, DP conversation thread adapted to public audience, calls-to-action, comment section, user reaction in posts, DP custom avatar, and consent of privacy limits).

However, actions associated with strategies linked to consistency and active engagement were either not reported (i.e., Set up at least 3-5 weekly tasks, consistent forum content postings), or among the least reported ones (i.e., responsive DP manager communication, storytelling, questions to users, open-ended questions, self-introductions between users and DP managers, user-tagging in posts, and content report to DP managers). This is problematic since consistency in content posting and engagement are some of the most important factors in digital user retention because of their importance in building a sense of community (Lopez-Gonzalez et al., 2014; Mailey et al., 2019; Tague et al., 2014).

Also, given that personalisation in the digital world is a factor that contributes to user immersion in a specific digital environment (O'Brien & Toms, 2008), the low report on actions related to it (i.e., collaboration with post imagery, self-introductions between users and DP managers, interactive podcast content, camera feature available, DP custom usernames, dashboard personalization), might be a contributing factor for decreasing engagement over time.

The fact that engagement strategies are not specifically strategised with validated models seems to be one of the greatest problems found in this DP analysis. This ongoing gap in guideline availability might influence the recurrent mention of difficulty in lengthening long-term engagement in DP (Edney et al., 2017; Manzoor et al., 2016; Tague et al., 2014).

#### 4.4 Credibility in DP

As for the credibility of DP, according to our adapted version of Bagrichevsky and Vasconcellos-Silva's (2019) checklist, DP seem to have included most of the indicators thoroughly, with the relevant indicators being highly present in most of the DP. The investment of DP in indicators associated with community engagement is quite positive (Kalgotha et al., 2021).

The fact that endorsement and promoting body are among the least reported might be a positive indicator when it comes to DP credibility. It might show that DP are reluctant to use famous personalities and/or institutions as leverage to uphold credibility and motivate PA as the use of public figures can create inadequate dependability to sustain behaviour change. Nevertheless, associating with specific promoting bodies connected to governmental health initiatives might also help validate the DP regulation and value towards current and potentially new users (Bagrichevsky & Vasconcellos-Silva, 2019), making it a more trustworthy community for users to rely on long-term (Kolt et al., 2020).

## 5 LIMITATIONS AND FUTURE DIRECTIONS

Although we strived for a comprehensive search procedure, only the free versions of DP were examined, thus it is possible that we did not capture the full range of engagement strategies used. The categorisation of user engagement strategies was based on the author's expertise rather than verified models, which were non-existent. Direct studies of long-term user participation and engagement would provide more detailed insights. Additional research into app downloads, platform formats, and user engagement patterns over time, including usage frequency, is needed.

Furthermore, investigating correlations between PA types, language availability, launch dates, updates, user numbers, and monitoring devices may shed light on their impact on DP characteristics, BCT, engagement strategies, and credibility indicators. Addressing factors such as privacy concerns and market competition, which limit data disclosure, may contribute to further research in this field.

## 6 CONCLUSION

Existing research and DP for promoting PA lack detailed information about their characteristics, user engagement strategies, and BCT. While progress has been made in understanding the function of OC in promoting PA, there are still substantial gaps in user engagement and long-term retention. Future research, including extensive case analyses, is required to assess the efficacy of various strategies and techniques, ensuring that platforms are better suited for retaining user engagement and promoting behavioural change.

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